Table of Contents


```
clear all;
close all;
```

Model 2 with parameters from 3.1

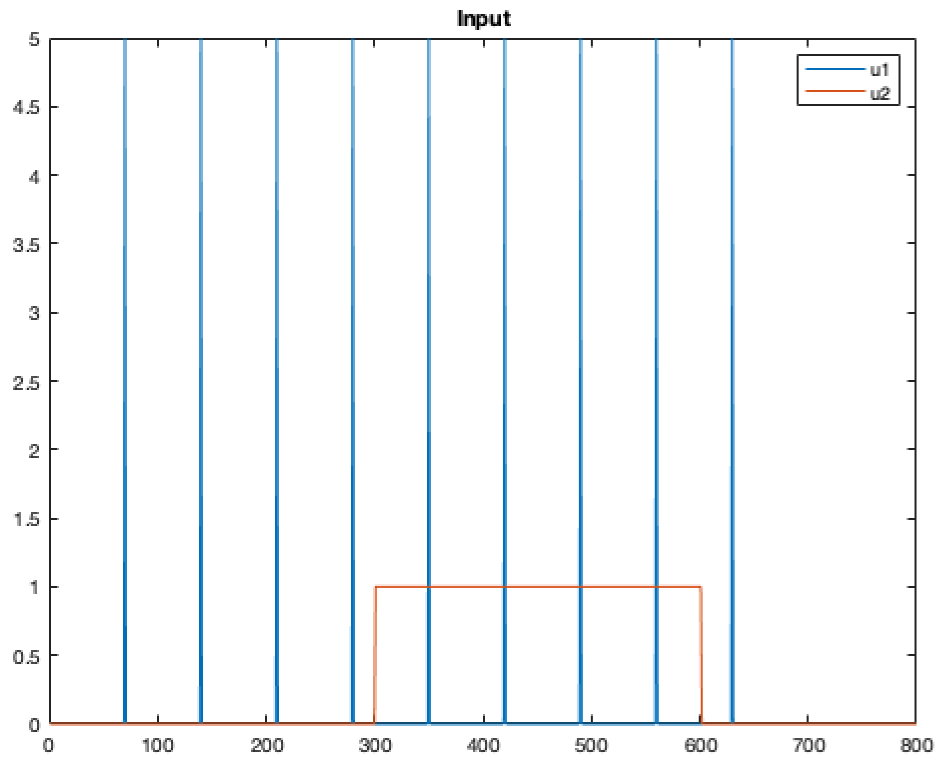
neural model construction

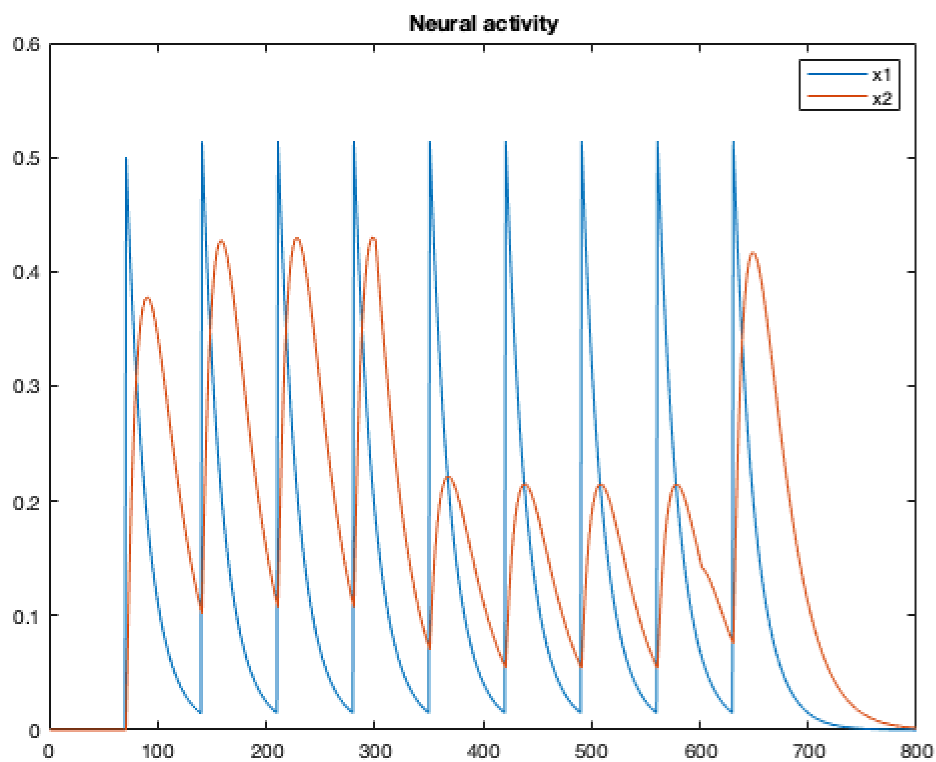
```
%construct struct P of matrices A and B and vector C
P.A = [-0.5,0;1,-0.5];
P.B = [0,0;-0.5,0];
P.C = [1;0];

%define x0 at t = 0
x0 = [0;0];

%construct u
u_vector = zeros(2,800);
u_vector(2,301:601)= 1;
u_vector(1,70:70:631)=5;

% hrf model construction

%hemodynamic state vector at t=0 (s,f,v,q)
h0 = [0;1;1;1];

% prameters for hrf : kappa, gamma, tau, alpha and E_0
Phrf=[0.64,0.32,2,0.32,0.4];

% compute dcm
t = linspace(0,80,800);
[y,h,x] = euler_integrate_dcm(u_vector,P,Phrf,x0,h0);
```

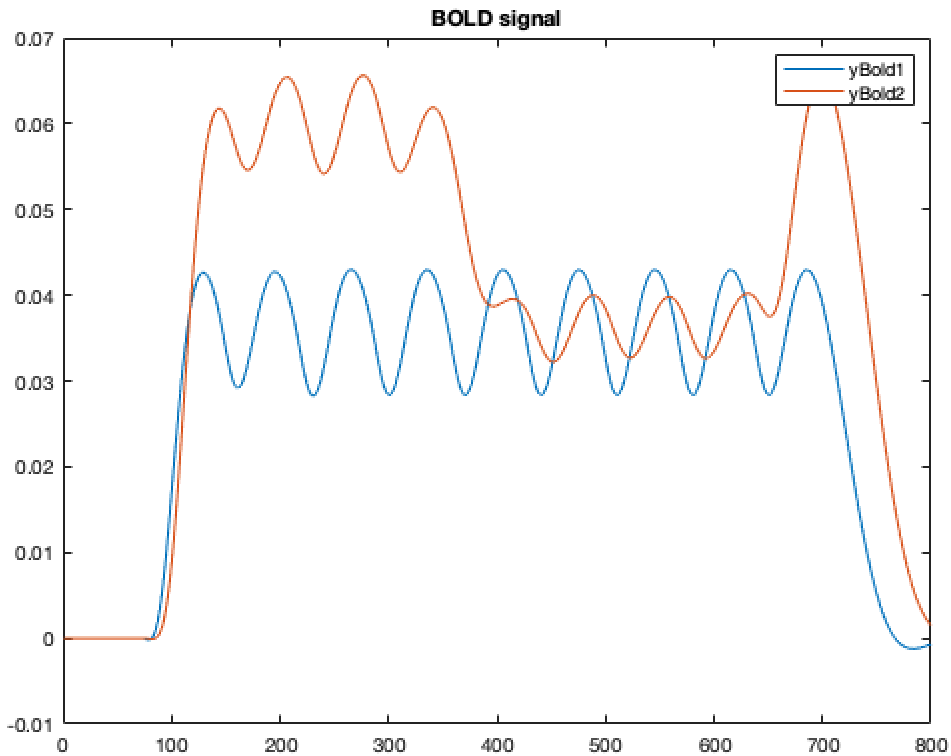
a) generate noisy BOLD trace \hat{y}

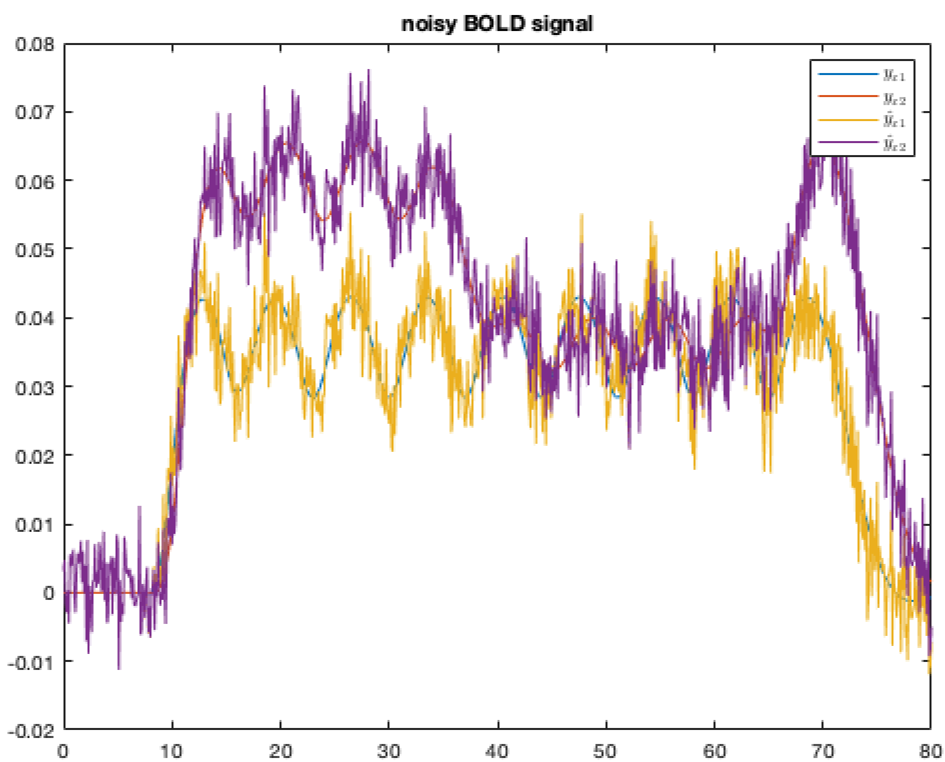
```
sigma = 0.005;
y_hat = zeros(2,800);
for i = 1:800
    noise = normrnd(0,sigma);
    y_hat(:,i) = y(:,i) + noise;
end

figure(1)
plot(u_vector(1,:))
```

```
title('Input')
hold on;
plot(u_vector(2,:))
legend('u1', 'u2')
hold off;

figure(2)
plot(x(1,:))
hold on;
plot(x(2,:))
title('Neural activity')
legend('x1','x2')
hold off;

figure(3)
plot(y(1,:))
hold on;
plot(y(2,:))
title('BOLD signal')
legend('yBold1','yBold2')
hold off;


% plot trace
figure;
plot(t,y(:,:));
hold on;
plot(t,y_hat(:,:));
legend('$y_{x1}$','$y_{x2}$','$\hat{y}_{x1}$','$
\hat{y}_{x2}$','Interpreter','Latex')
title('noisy BOLD signal');
```


Input
u1
u2


Neural activity
x1
x2


BOLD signal
yBold1
yBold2
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
0
100
200
300
400
500
600
700
800


noisy BOLD signal
y_{r1}
y_{r2}
$\bar{y}_{r1}$
$\bar{y}_{r2}$
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
0
10
20
30
40
50
60
70
80

b) compute log-likelihood

```
llh_y1 = -0.5 * log(2 *pi * sigma^2)-0.5*(y_hat(1,:)-
y(1,:))*(y_hat(1,:)-y(1,:))'/(sigma^2);
llh_y2 = -0.5 * log(2 *pi * sigma^2)-0.5*(y_hat(2,:)-
y(2,:))*(y_hat(2,:)-y(2,:))'/(sigma^2);
```

c) compute log joint distribution

Published with MATLAB® R2018b